



THE ORIGIN
OF 8.
ZYMOTIC DISEASES.

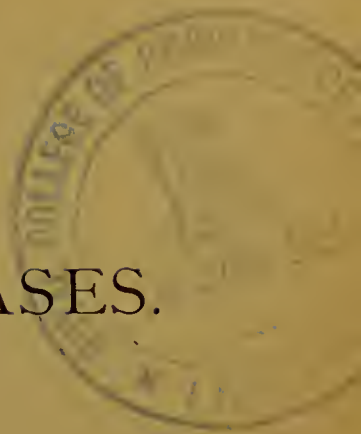
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THE ORIGIN OF ZYMOTIC DISEASES.



Some five and twenty years ago, the writer of this article was a member of a small association formed by some of the students of University College, London, called the Zetetic (*i.e.*, seeking out) Society, the purpose of which was well expressed by the name: the students took it in turns to write an essay to be read at a meeting of, and afterwards discussed by, the Society. According to the rules, the essay was subject to only one restriction, *viz.*, that it should embody original work. When my turn came for a paper, I chose as my subject "Zymotic Diseases," having been led thereto by the interest I had taken in the discussions then going on about "Spontaneous Generation," of which theory one of our professors was recognised as the foremost champion, and partly owing, also, to the much-talked-of epidemic of smallpox, on account of which most of the students were compelled to be re-vaccinated. I had noticed that variations in the course of the diseases were concomitant with variations in the lives of animals, and I collected all the variations I could, showing that from the commencement to the end of the disease, its whole course was *as if* caused by the presence of living germs, which,

therefore, I said, it might be ascribed to. As I read the essay, every point I made was received with laughter, and when I sat down it was only treated with jokes and good-natured ridicule, except by one student, who deprecated such treatment, and pointed out that not one of my facts was contested, yet even he altogether refused to accept the conclusion. The paper received but one compliment, and that from a student who is now an eminent member of the House of Commons, who said it was well to indulge in fun at times for a change, and that after the serious papers they had had my string of absurdities afforded a capital evening's amusement.

I recall this incident to show how a fair statement of the now universally recognised germ theory was received twenty-five years ago, because now, with the good-natured laughter of my friends still ringing in my ears, I wish to state a theory of the origin of these diseases, which, I fear, will excite even more laughter, from some of those who read it, than did my previous essay, and to ask those inclined to laugh to remember that, as before, I may again be right.

My theory is that the germs which cause zymotic diseases are reversions to primeval larval forms of insects, and that, therefore, these insects are the origin of the diseases, *e.g.*, that cholera originates with the common house-fly, typhoid with the aphis, and diphtheria with the louse.

The connection of the common house-fly with cholera has been so frequently stated as to be a matter of common

knowledge, but the connection usually attributed to it is that of a carrier of the germs of the disease ; but why, if the germs are so disseminated, should it always be the house-fly that acts as a carrier and not other insects? Cholera is a disease of tropical climates, where the insect tribe are most numerous and are in endless variety ; surely then there must be some closer causal connection to account for the solitary instance of this one insect.

Cholera is a summer disease, and appears after flies are about, and, as they increase, so it is that in the height of summer and later, outbreaks of cholera occur.

Flies deposit their eggs in fœcal and decaying matter, and cholera is recognised as a filth disease, which, while generally attacking the whole body, is particularly a disease of the bowels, and physicians regard the disinfection of excreta of patients suffering from it as of the first importance.

Assuming the truth of the larval theory of disease, all recorded observations tend to implicate the house-fly as its origin.

The connection of the aphis with typhoid is far closer ; so much so that it is impossible the connection can be one of carrying germs.

The outbreaks of extensive epidemics frequently occur near to orchards and places where fruit is largely cultivated, and consequently where the aphis is abundant.

Reproduction in the aphides is the best known case of parthenogenesis, *i.e.*, the female insect produces generation after generation of live and equally fertile females without any connection with the male; all through the summer and warm weather this goes on; when cool weather begins normal sexual reproduction follows; the female then lays eggs in place of giving birth to live females; and it is after the cooler autumn weather and the normal sexual and ovoviviparous development of the aphis that any epidemic or exceptional outbreaks of typhoid occur.

Here we have not only the concomitance between the disease and the aphis, but also between the egg of the aphis and the disease.

Typhoid fever is a disease of temperate climates, and aphides do not exist in the tropics, being replaced by another order of insects that displace them by natural selection.

Here we have two diseases breaking out sporadically at all times and places that are consistent with some causal connection with these two insects, and never apparently at other times or places.

They occur epidemically when the eggs of the insects would be most numerous and under circumstances of time, place, and temperature, always consistent with such causal connection. In the case of typhoid it is specifically so both as to time and temperature.

Where they differ most is that the eggs of the fly are laid in hot weather, and cholera is emphatically a tropical

disease which disappears with cool weather, and almost never appears sporadically in temperate climates.

Typhoid only appears sporadically in spring and summer, and epidemically in the autumn, just as the aphid eggs are produced abnormally in spring and summer, but normally and in enormous quantities on the approach of the cold weather, that would put an end to the order if viviparous development continued.

As regards other fevers, I have never been able, though constantly on the look out for it for many years, to find the slightest indication that any one insect is a possible origin of scarlet fever or measles. To any one desiring to follow up the theory, I would suggest that members of the gnat or mosquito family (Culicidæ) are probably the origin of dysentery, malaria, and ague, and the coccidæ of yellow fever, but the indications I have noted are such as would suggest themselves at once to any one interested in the subject, and who would take the trouble to enumerate the concomitant variations between the lives of these insects and the respective diseases, but a far stronger though not conclusive indictment can be brought against the gadfly as the origin of smallpox. This, however, if any interest in the theory can be excited, ought soon to be set at rest and be the next discovered origin, for Jenner, in his classical researches on the disease, was led to his theory of vaccination and his source of vaccine, by observing that dairy-maids were proof against smallpox after milking cows whose teats had ulcerous sores on them. These sores being presumably caused by

development of the larva from eggs deposited in or on the teat, or possibly in or on the skin of the beast, it ought to be possible to follow up Jenner's observation, and see what insect deposits the eggs. Meantime it would be well to be careful of the gadfly and its eggs, for its sting or any development from its eggs may be exceedingly dangerous—possibly originating smallpox. I do not give the indications in this paragraph with the idea that they give reliable means of prediction, or are in themselves of any value, but only in the hope that the theory might excite sufficient interest in some one or more to follow it up, and be a help to him or her in starting on the points next to be cleared up.

On the other hand, as regards diphtheria, I have so frequently observed the concomitance and sequence of the disease with the prevalence of lice, that I am as well satisfied they are the origin of the disease as I am that the aphid is the origin of typhoid, or the house-fly of cholera. This is a rather difficult case, because the life of the insect does not give any peculiarities of development that fix the concomitance so far as I can make out, so I can only rely on the presence of the insect from personal observation; and any one wishing to follow it up must not take just any case of the disease and look for its insect origin any more than do so with cholera, for they are both highly contagious, but look out for the nature of the surroundings where it is heard of, and especially any place where it is prevalent, and see whether there is any concomitant prevalence of lice in the district. The case against the house-fly as the origin of epidemic diarrhoea is very singular, but with the exception

of not being a matter of common remark, seems to me to be the same as for cholera, and if it should be so we shall have two reversions from the same insect, or, possibly, varieties of the same insect, unless we look upon this as a mild form of cholera.

Now, with regard to the germ developed from the egg. In, for instance, the case of typhoid its specific origin from the egg can scarcely be doubted, but that still leaves open the question, What is the germ arising from it? Clearly it is not the ordinary larva, one-sixth of an inch in length, a vegetable feeder, and the free embryo of a single insect; nor do I see how it can any longer be classed, as it is at the present time by bacteriologists, as a member of the vegetable kingdom, especially when the origin of the classification is examined, for it all arose out of the misleading analogy made by Pasteur, who, when he had completed his classical researches on Yeast—unquestionably a member of the vegetable kingdom—and commenced his still more famous researches on Disease Germs, erroneously assumed they were all of equally vegetable origin. Analogy is always the flimsiest kind of reasoning, never more than a sign pointing in a certain direction, without any further reason for assuming it to be the right one; yet on this mere ghost of a reason there has been set up an artificial classification (*i.e.*, a non-natural one, not based on organisation or functional action), and the whole of the “Bacteria” shelved wholesale into a class between the Fungi and the Algæ. All I am here concerned with is to show that the germs of Zymotic Disease have been so placed

on the strength of a slender analogy, which may surely be dismissed as worthless, when we remember that the whole classification is artificial, just as reasonable—neither more so nor less—as classifying all animals according to their colour; and I am persuaded that no considerable advance can be made in the Science of Bacteriological Diseases until a natural classification is made, starting with the fundamental division of germs and spores, which represent the animal and vegetable kingdoms.

Dismissing, then, the ordinary larva and the vegetable “bacillus,” what is it that arises from the egg? Is it some reversion to an earlier larval stage, and, if so, what? I can find no consistent explanation of the phenomena, except that it is a reversion to an earlier larval form; but here again we are unfortunately met with the fact that such is distinctly contrary to theories current amongst leading scientific men, so that we must proceed warily, and see how far these theories are valid as against our facts. The accepted view of the larva is that it is a secondary development of the embryo; that is to say, that the original and normal growth of the embryo in the egg would be to form a perfect insect, without larva or pupa, but that, for reasons we need not state here, the embryo has been hatched before its normal time, with the resultant development of the secondary forms of larva and pupa, so great an authority as the originator of this theory stating categorically that “there were, I believe, perfect insects before larvæ and pupæ.” (*Fritz Muller, “Facts for Darwin,” p. 121.*)

Now, in the face of such a statement, it would ill-become us to ignore the views of the great German zoologists, all of whom accept this theory, and have been followed in doing so by the rest of the scientific world, and hypothecate explanations of phenomena which are at variance with them, for we as a nation have played but a sorry part in entomological science and the later investigations of disease germs ; nevertheless no theory is too sacred for a man of science to examine and contest it, and no authority with him will weigh against evidence. Certainly no secondary development of a larva, normally developing to a single insect, could in any way become the minute germ of zymotic disease, which multiplies rapidly and indefinitely.

The grounds on which Fritz Muller's theory can be supported are twofold, viz., positive embryonic evidence and negative fossiliferous evidence.

Taking the latter first, it must be admitted there is no fossiliferous evidence recorded in the text books of geology showing the development of larvæ from earlier forms, but this amounts to nothing, seeing how soft, and therefore difficult of fossilisation, are all the larval forms. Bivalve shells can be found by the millions in ancient formations, but where has there been found one fossil of an oyster or mussel, or similar animal, even though their fossilisation would be assisted by protection from the shells, so that this negative evidence can be dismissed as perfectly worthless,

The embryonic evidence can be summed up in the statement that certain organs, particularly of the mouth, appear during development within the egg in a form resembling that in the imago or perfect insect, and differing from the same organs in the larva, from which it is inferred the original development was direct to the perfect insect, and that the larva is a secondary development since the perfect insect was formed.

Here the embryonic evidence is positive fact, capable at any time of verification, but the conclusion drawn is hypothesis pure and simple, and is no better than any other hypothesis that will equally well agree with all the facts; for instance, that the organs of the imago are a reversion to a former type, from which the present larva has grown—the true interpretation of the facts, as other evidence will show. If these two hypotheses stood alone without other evidence, neither could be used as evidence against any theory that agreed with the other, and the fact that this other agreed with a theory that explained independent facts—as this larval theory of zymotic disease—would be strong evidence of the truth of the latter, and consequent falsity of the accepted hypothesis—in this case of Fritz Muller's.

Again, that there is nothing in the changed organs of the mouth, &c., of the larva but what may reasonably be ascribed to development dependent on the special life of the larva—its environment—can be at once inferred from two following extracts from Lubbock ("Origin, &c., of

Insects," pp. 70 and 72):—"The larva of an insect is by no means a mere stage in the development of the perfect animal. On the contrary, it is subject to the influence of natural selection, and undergoes changes which have reference entirely to its own requirements and condition." "It cannot be denied that the innumerable variations in the mouth-parts of insects have special reference to their mode of life, and are of some advantage to the species in which they occur."

Next, if the original development was direct to the insect, we should expect to find frequent cases of reversion to the original development. For reasons to be stated later insects are among the most liable of all animals to reversion, and in all animals secondary developments are the most liable to be left out and cause reversion, as Prof. Balfour states ("Comparative Embryology," p. 299):—"There is always a strong tendency for . . . a secondary intercolated link in the chain of development to drop out by the occurrence of a reversion to the original type of development." Yet these reversions that might be expected from Fritz Muller's theory to be so frequent never take place, and their absence is the very strongest evidence, amounting almost to proof, of the falsity of the hypothesis.

Next, that the imago should revert in some of its organs in passing through the pupa stage is precisely what might be expected, for there its whole being is resolved into its organic elements, to be re-formed from an animal crawling on the earth to an animal flying in the air; and in this

resolution of its elements into a new form it would, in accordance with Darwin's "Principle of Natural Selection," take the earliest form that would be suitable for the coming creature—that is, the one requiring the least expenditure of energy of development; and when we find the organs of the mouth or other organs reverting in this expected way we should look upon them as the most valuable of all embryonic evidence as to the former life condition of the larva, and from its constancy in the imago we can infer its persistence in the past time in the larva.

But in truth this belabouring Fritz Muller's theory is only necessary on account of its universal acceptance by scientific men all over the world, and its complete opposition to the larval theory we are explaining (if one of them is true the other is false), as we can deduce a complete disproof of it from the great philosopher's own statements, for, says he ("Facts for Darwin," p. 121):—"If all the classes of Arthropoda (Crustacea, Insecta, Myriapoda, and Arachinda) are indeed branches of a common stem (and of this there can scarcely be a doubt), it is evident that the water-inhabiting Crustacea must be regarded as the original stem from which the other terrestrial classes with their tracheal respiration have branched off."

As well might it be said that because the Amazon and the Severn can be traced to a common outlet in the Atlantic Ocean, therefore the Amazon is a branch of the Severn. Traced back to a common stem, the source is as much "the original stem" of any one as of the others, and the water-

breathing system of the one and the tracheal system of the others are neither branched off from the other, but are both developed adaptations of an original system.

We have, therefore, to trace back the larva to the earliest we can, and since the more complicated form is descended from a less complex, the perfect animal is, in all these orders, derived from the larva, which we must look upon as the stem of descent in each order going back in one unbroken line to the common origin of them all.

But we know from the embryology of the diptera, that the most ancient form of the larva of which we have direct evidence, was one having a suctorial mouth, and, therefore, of aquatic feeding habits “dipterous maggots have evidently descended from a larval form, which possessed a horny head with antennæ and three pairs of legs, but which had no appendages to the abdominal segments; they are, therefore, ordinary dipterous larvæ of the gnat type, which have become modified in a quite peculiar manner and adopted to a new mode of life.” (Weisman Studies in Descent).

This is as far back as we can carry the history of the larvæ by direct evidence, viz., to a vermiform body with suctorial mouth, such a worm as would be capable of living in water and mud; and since fossils of perfect insects are found in the Carboniferous and Devonian strata, the larvæ from which they originated previous to the formation of perfect insects, must have been prior to the Devonian, and presumably to any known stratified rocks.

Still, these well developed worms, ancient as they are, could not be the minute germs of zymotic disease, and we are stranded on hypothesis to explain how they can have arisen by reversion.

I suggest the following as a complete explanation of all the facts; as giving a reasonable descent of insect life, both as to correlation of orders, as to concomitance of forms, as to sequence in time and position, and as giving a complete explanation of the zymotic diseases through reverted larval forms, and it, I think, can be taken as true, for it is capable, as we shall see, of the most beautiful and interesting verification that ever the hypothesis of mortal man has had.

Carrying the worm back in imagination to vast depths of time before the earliest records of the rocks, imagine it stripped successively of each segment, and finally become few or a single cell, and to a time when the world was without visible animal or vegetable life, a desolate waste of earth and water, on which the sun shone down through a dense atmosphere surcharged with carbonic acid gas, on the stagnant pools and marshy ooze, in which dwelt, as in similar places they do now, the tiny germs and spores, each living upon the destruction of the other, the primordial genitors of all living things upon this earth, that have been, are, or are to be.

There, just as now, with alternate seasons, wet and dry, the primeval elements of life and the forms developed from them, would frequently be subject to be dried up and

killed unless they developed an integument within which they could lie quiescent during dry weather; this is the cystic state of worms, and the pupa stage of arthropoda; and is the cystic and aerial stage of the primeval elements; the cyst and pupa have developed to perfect worms and articulate animals, with, of course, the frequent suppression of parts of the development, even to the extent of cyst and pupa previously existing, yielding ultimately such perfect animals as tænia worms, crustaceans, and perfect insects; and through all these vast developments of time, the primeval elements remain unchanged and unchanging, like the globigerina found everywhere at the bottom of the sea during the "Challenger" expedition, identically the same as that found fossiliferous in the earliest rocks; and these changeless primeval elements are not only wonderfully prolific in suitable environment (such as the body of man in cases of zymotic disease), but in cystic or dried forms show wonderful vitality in time; and besides this inherent vitality they are continually reproduced from higher forms by the Cataclysm of Reversion, assisted by each animal in going through its complete lives being twice resolved into its organic elements, once in the egg and once in the pupa or cystic stage.

A study of the plagues affords the complete verification of this hypothesis that we are dealing with primeval elements; their ulterior causes are always economic; this is not a matter of inference but of fact beyond dispute to anyone who will go through the lengthy evidence obtainable

at any library ; also the same applies to typhus fever ; but typhus breaks out much more readily, and is always of the same well marked type ; so rapidly and certainly does this occur that it has passed by the names of famine fever, gaol fever, camp fever, etc., and if any large body of men are congregated together in extreme poverty for any considerable time, typhus fever can be relied on to appear in its well marked type.

When plague appears it is under the same conditions, but is very infrequent in appearance, and of no well marked type—the difference is very great between different plagues, yet they all agree in many points.

Examining their points of agreement we find they are all the same as are found in typhus fever.

Examining the points in which they differ, they here exhibit on each occasion a wonderful agreement with some one or other of the zymotic diseases not typhus.

From this I conclude they are hybrid diseases, crossed between the germs of typhus and some one other of the germs of zymotic disease, and further examination proves this beyond a doubt to be the case ; and these germs are very closely related, for all the characteristics resemble one or other of the parents, just as the offspring of nearly related living forms always do ; while the offspring of distantly related forms of life are more or less “freaks,” compounded of distant ancestors whose descent is more difficult to trace from absence of resemblance to their parents.

The commonest of these plagues is the bubonic, or, as I should prefer to call it from its derivation, the choleraic plague.

The *pestis minor*, or mild plague, appears to be a cross with diarrhœa germ.

The Great English Plague of 1665 was, from the descriptions handed down to us, of the ulcerated stomach and intestines, and the frequent hæmorrhage, a distinctly typhoid plague.

The most frightful disease from which the human race is known to have suffered was the black or dysenteric plague, shown by the patches of membrane usually evacuated with dysentery, separating also from the lungs or skin, causing the recorded bleeding from the lungs and the patches of uncovered flesh with dark venous blood exuding and giving the name to the disease.

In the account in Exodus, Chapters VIII. and IX., if the verses 10 and 11 in Chapter IX. are taken to be a description of diphtheretic plague, the agreement of the text with the larval theory of disease is perfectly exact both as to concomitance and sequence, and vindicates the historical accuracy of this part of the Hebrew Classics, while it also gives a clue to what may be the origin of the murrain or cattle plague—at all events there is an indication of a possible origin that in the light thrown on it by this theory ought to be followed up.

I can see no reason why the germ of typhus fever should not at any time cross with the primeval larval form of any

insect it may be brought in contact with, so that when typhus is allowed to get a start, there is no telling what virulent plague the race may at any time be afflicted with.

Typhoid, cholera, diphtheria, and, it appears, all other zymotic germs except typhus, feed on the epithelial linings of the cells and the gelatinous parts which form the framework of the body; the typhus germ on the nitrogen-starved contents of the cells themselves; the plague germs feed on both; hence plagues are rapidly fatal; typhus leaves no sequelæ—for the framework of the body remains intact, and other zymotic diseases are all liable to be followed by more or less serious complaints—often life-long burdens; this accounts for the treatment of the latter diseases by physicians, more or less unconsciously, being an attempt at the nitrogen starvation of the germ; while people fed on nitrogenous food, say a fair amount of digestible pulse (beans, peas, lentils, etc.), and whose framework remained ealthy, would never be subject to any plague epidemic; but *per contra* any patient as now ordinarily treated for typhoid fever who became exposed to typhus germs during the treatment would be dead certain to get plague.

Finally, that we are dealing with primeval elements is certain, from the fact of these germs crossing in the way they do; we get, not a mule, as we should do from different species, but a highly fertile and vigorous offspring—there being nothing more vigorous or fertile than plague germs; according to Charles Darwin (*Animals and Plants under Domestication*, Vol. II., page 158) “Abundant evidence has

been given that crossing adds to the size, vigour and fertility of the offspring; this holds good when there has been no previous close inter-breeding. It applies to individuals of the same variety, but belonging to different families, to distinct varieties, sub-species and even species; in the latter case, though size is gained, fertility is lost."

From which it follows that these elements yielding, when crossed, vigorous and fertile offspring, are not species but varieties, which still must be distinctly different varieties, as they give such different diseases to man. The important point is that we have traced back the descent of such important orders as Apterous, Hemipterous, and Dipterous Insects, all of which have large numbers of species which will not cross (much less will the orders cross) to the time when they were mere varieties yielding vigorous and fertile offspring, and therefore the primeval elements of the orders.

Reverted primeval larval forms of insects are the cause of, and insects are therefore the origin of, Zymotic Diseases.
Q.E.D.

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